

China Tech Decoupled

**How China is building up
a comprehensive domestic I.T. infrastructure
from chips to operating systems to applications**

November 2021

About FutureLogic

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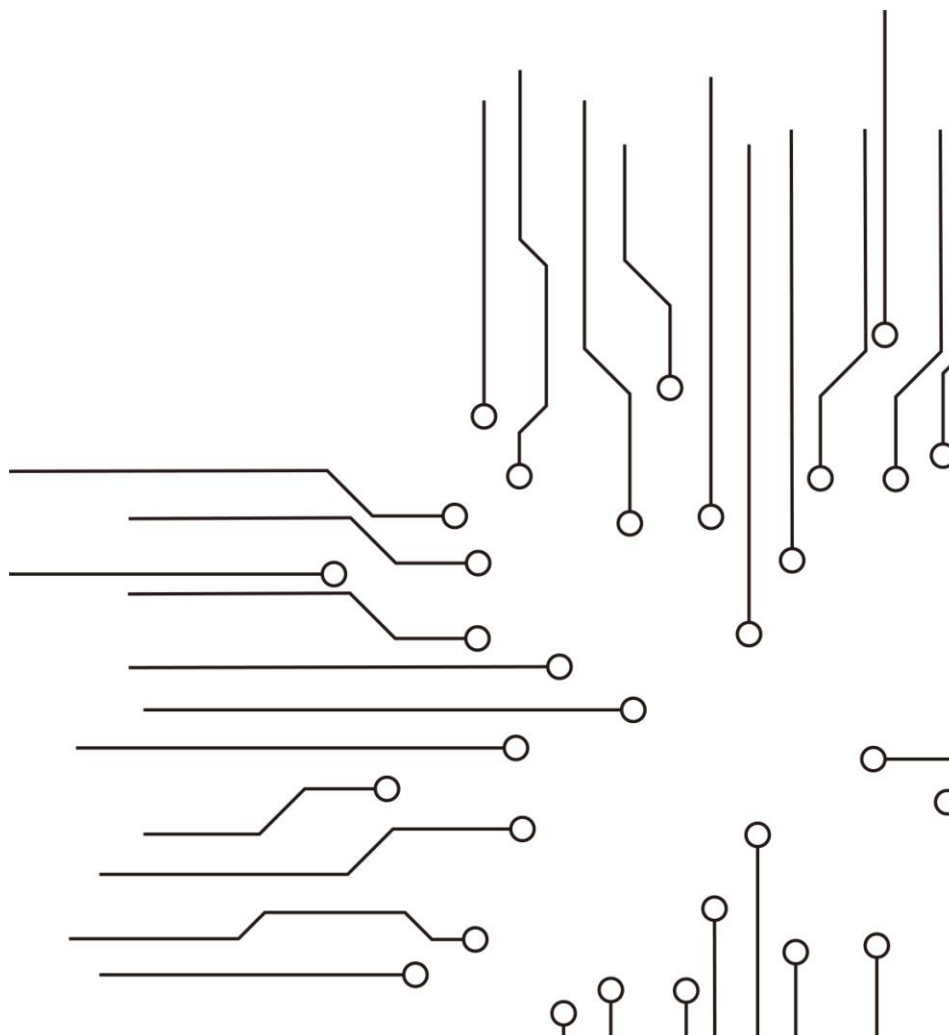
It encompasses a number of media and data assets, including China Money Network, a platform tracking the Asian venture capital and technology sectors since 2011; and Caishen.co, which uses natural language processing to provide market intelligence on China's secondary market.

FutureLogic's asset matrix also includes China Money Podcast, a weekly podcast featuring China's venture capital and tech sector news; and China Money Reports, a think tank producing reports related to the Chinese and the global tech ecosystem.

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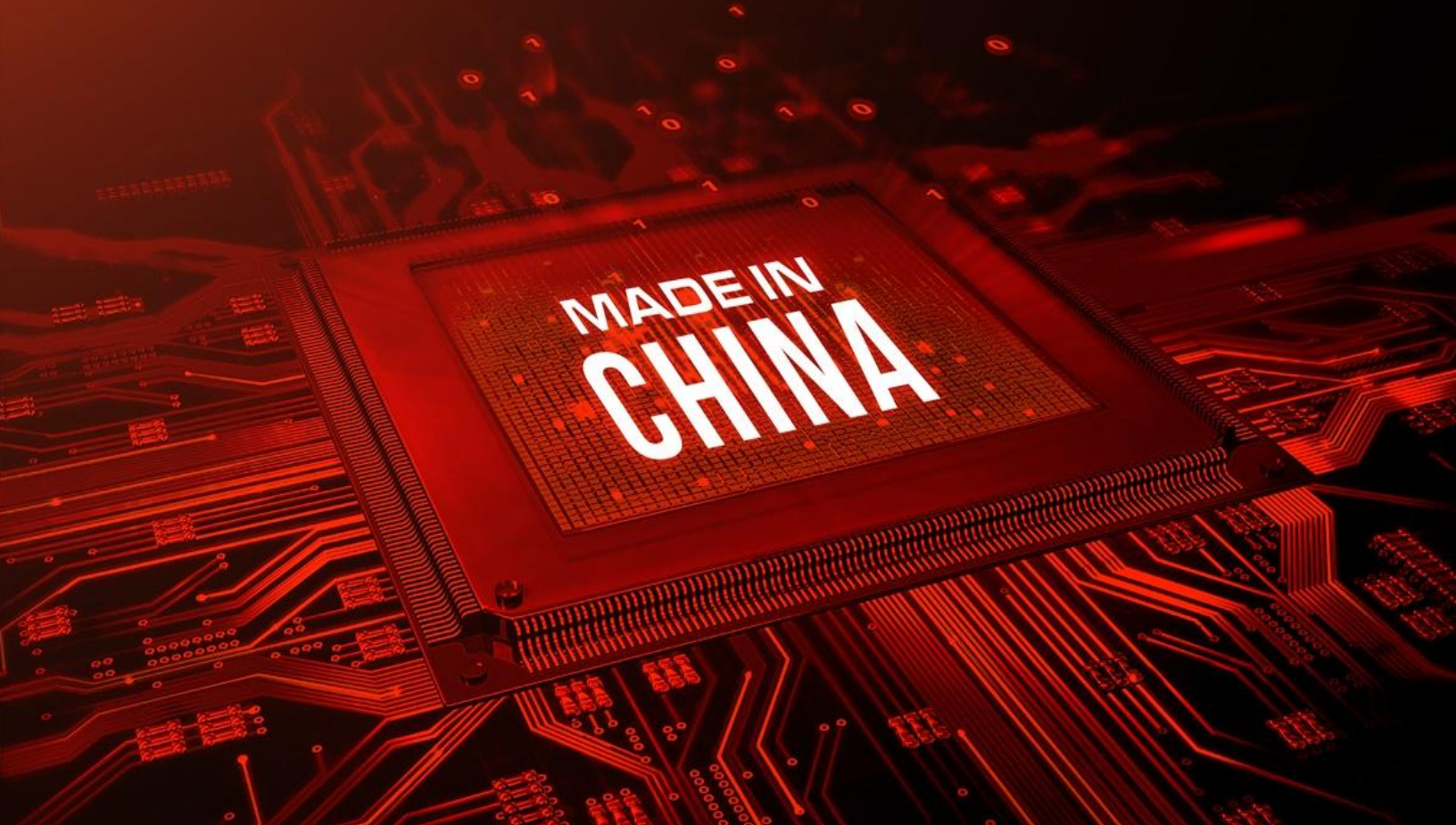
Executive Summary

China's effort to build a domestic-centric I.T. infrastructure began in earnest after U.S. sanctions of ZTE Corporation and Huawei exposed the country's core vulnerabilities of foreign reliance. The Xin Chuang industry is a core part of this effort tasked to create a comprehensive, self-reliant Chinese domestic information technology industry from chips, operating systems, and applications.

Beijing and local governments have launched numerous supportive policies to promote the development of the Xin Chuang industry, which is expected to exceed U.S.\$52 billion in scale in 2023, while the overall market capacity will exceed RMB1 trillion Yuan (U.S.\$155 billion).

The Xin Chuang industry consists of four parts: basic hardware, basic software, application software, and information security. Chips, computing devices, operating systems, databases, and middleware are some of the most important components of the sector.

Domestic leaders have emerged in each of these categories, but many sub-market remain in the early stages of development toward self-reliance and will require decades of effort to achieve domestic substitution. Therefore, China will remain dependent and integrated with the global tech ecosystem. The country's tech decoupling away from the global system will be selective and confined to certain sectors in the foreseeable future.



Introduction

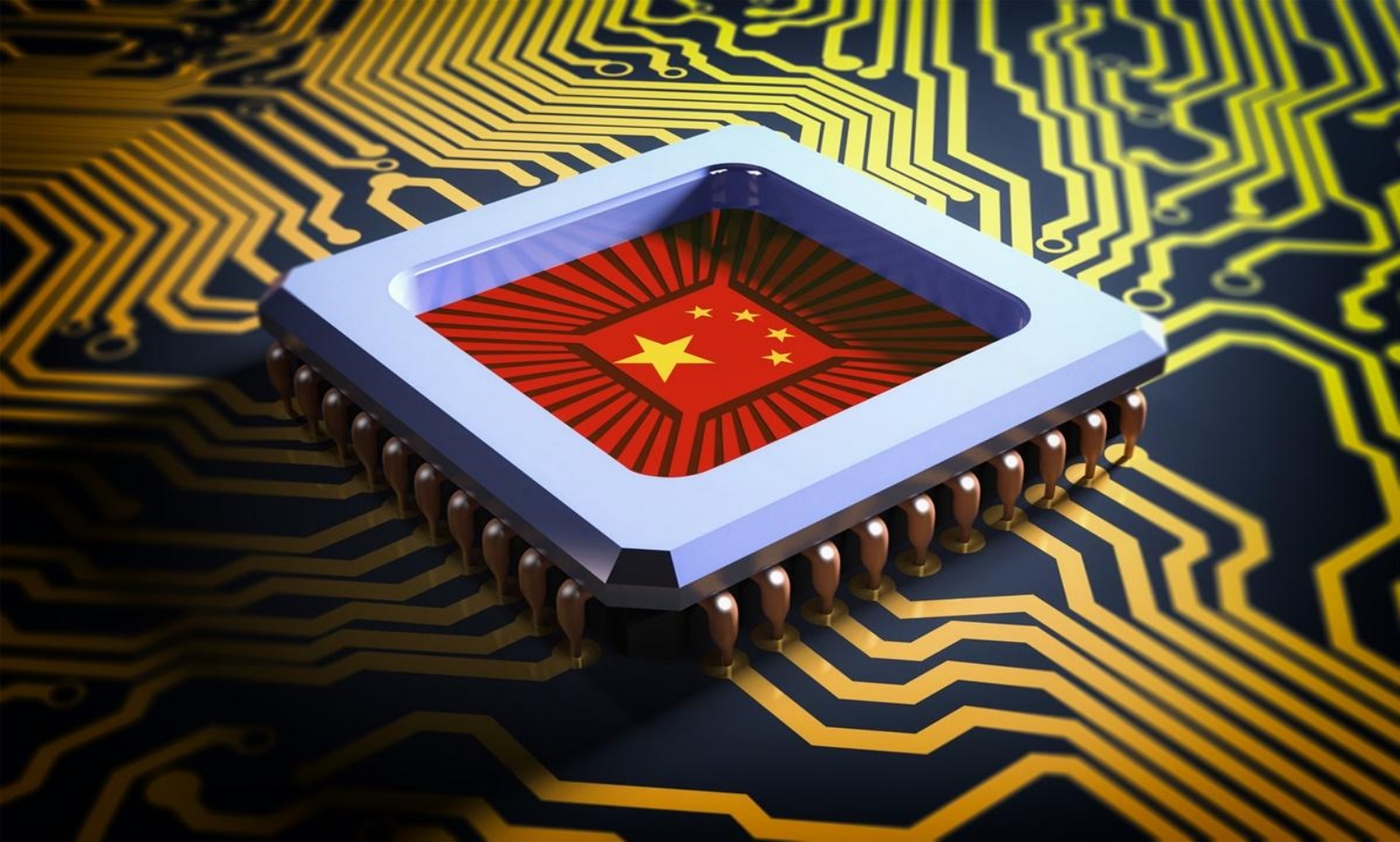
The U.S.'s ban against Chinese telecommunications firm ZTE Corporation in April 2018 proved to be something of a Sputnik Moment in China. It laid bare the country's heavy dependence on foreign technology, particularly in a critical industry: semiconductors. It exposed a core vulnerability of the entire Chinese industrial and technological ecosystem to external disruptions.

The fact that ZTE was pushed to the brink of financial collapse under U.S. sanctions generated a deep soul-searching within China about why the country's industrial foundations were so weak and what could be done to alleviate such dangerous foreign dependency.

Since then, a renewed national campaign to build up China's self-reliant supply chains picked up pace significantly. A new industry suddenly became the center of the spotlight for governments and private businesses. Referred to as *Xin Chuang* (信创), or Information Technology Application Innovation Industry, this industry aims to build up a comprehensive, self-reliant Chinese domestic information technology industry from chips, operating systems, and applications. The objective of *Xin Chuang* is a Chinese tech sector without Intel, Qualcomm, or Microsoft, or a tech ecosystem that is completely free from the threat of U.S. sanctions.

After some years of the self-reliance campaign and the build-up of the *Xin Chuang* industry, what progress has China made? What challenges does it face? Who are the major players? What should be expected from its future development? What are the implications for the global I.T. ecosystem?

This report will answer these questions via extensive research and analysis to provide the global tech community with much-needed insights and outlook of this important development in China.



Xin Chuang Explained

In March 2016, dozens of leading Chinese I.T. companies, universities, and research centers jointly established a non-profit organization in Beijing called the Information Technology Application Innovation Working Committee.

This committee is referred to as *Xin Chuang Working Committee*, which is the earliest appearance of the term *Xin Chuang* in China. Numerous regional *Xin Chuang* entities were established thereafter, forming alliances across the country and marking the beginning of the *Xin Chuang* industry.

Exhibit 1- A List of Founding Entities of the Xin Chuang Working Committee

Category	Entity Name
I.T. companies	China National Software & Service, Taiji Computer Corp, Aisino, Inspur Group, D.H.C. Software, Shenzhou Aerospace Software Technology, Neusoft, DCITS, THTF, Thunisoft, Alibaba Cloud, Kingsoft, Huawei Technologies
Research centers	National Industrial Information Security Development Research Center, China Electronics Standardization Institute, The Fifth Electronic Research Institute of The Ministry of Industry and Information Technology, China Center for Information Industry Development
Universities	Beijing University of Aeronautics and Astronautics, Beijing Institute of Technology

Source: Information Technology Application Innovation Working Committee official website.

The original purpose of the *Xin Chuang Working Committee* is industry self-discipline to ensure standardized market operation and orderly competition, to provide support on technology, standards, and talents, and to promote resource sharing and coordinated advancement for the industry. Tech self-reliance was not explicitly stated in its mission statement.

But the term gained prominence after the ZTE Corp and Huawei sanctions. China's leadership has been keenly aware of the country's reliance on foreign technology, and President Xi Jinping has repeatedly aired concerns.

In 2013, Xi told the Ministry of Technology that "Internationally, there is no geopolitical power without the advantages of core technology. Great efforts should be made in (China's) key tech areas and areas where we have core vulnerability." In 2016, he commented that the Chinese internet sector's reliance on foreign core components is like "building a house on someone else's foundation" that would

not withstand wind and rain no matter how beautiful.¹

Such speeches didn't translate into urgent and earnest actions until U.S. sanctions crippled some of China's leading companies after 2018. Under U.S. sanctions, ZTE faced the possibility of bankruptcy. Huawei's two soaring businesses: its globally leading chip design unit HiSilicon and smartphone unit, saw their wings clipped.

As the list of Chinese companies placed on U.S. sanctions grew longer, governments and private industries pushed the *Xin Chuang* industry to the forefront with a strong united determination to end China's painful foreign reliance.

1.<http://m.news.cctv.com/2018/04/18/ARTIdwgrDYHnPrJSoFdBWLd0180418.shtml>

Exhibit 2 - U.S. Sanctions Against Chinese Companies & Entities Since 2018

Time	Event	Key entities impacted
Aug 2018	The U.S. Department of Commerce added 44 Chinese entities (8 entities and 36 subordinate institutions) to its Entity List, imposing technology restrictions on these companies on the grounds of them acting contrary to the national security or foreign policy interests of the U.S.	China Aerospace Science and Industry Corporation Second Academy, China Electronic Technology Group Corporation 13 th Research Institute, China Electronics Technology Group Corporation 14 th Research Institute, China Electronics Technology Group Corporation 38 th Research Institute, China Electronics Technology Group Corporation 55 th Research Institute, China Tech Hi Industry Import and Export Corporation, China Volant Industry, Hebei Far East Communication System Engineering
May 2019	The U.S. Department of Commerce added Huawei Technologies and 68 non-U.S. affiliates of Huawei located in 26 destinations to its Entity List after determining that there is reasonable cause to believe that Huawei has been involved in activities contrary to the national security or foreign policy interests of the U.S.	Huawei Technologies and its affiliates
Jun 2019	The U.S. Department of Commerce added 5 Chinese entities to the Entity List for accepting or utilizing forced labor in Xinjiang.	Hoshine Silicon Industry (Shanshan) Co., Xinjiang Daqo New Energy, Xinjiang East Hope Nonferrous Metals, Xinjiang G.C.L. New Energy Material Technology, Xinjiang Production and Construction Corps (XPCC)
Oct 2019	The U.S. Department of Commerce added 28 Chinese entities to its Entity List for acting contrary to the foreign policy interests of the U.S.	Xinjiang Uighur Autonomous Region People's Government Public Security Bureau and 18 of its subordinate municipal and county bureaus, Dahua Technology; Hikvision; IFLYTEK; Megvii Technology; SenseTime; Xiamen Meiya Pico Information; Yitu Technologies; Yixin Science and Technology Co. Ltd.;
May 2020	The U.S. Department of Commerce added 33 Chinese entities to its Entity List, saying some of them represented a significant risk of supporting the procurement of items for military end-use in China, while others for enabling high-tech surveillance in Xinjiang.	Beijing Computational Science Research Center, Beijing Cloudmind Technology, Qihoo 360 Technology, Intellifusion, Harbin Engineering University, Harbin Institute of Technology
Jun 2020	The U.S. Department of Defense published a list of 20 companies operating directly or indirectly in the U.S. and are Communist Chinese military companies. While not a sanctions list itself, the DoD List may lead to sanctions and reactions from business partners. ² In November 2020, then President Trump signed an executive order banning U.S. investment in the blacklisted firms. ³	Aviation Industry Corporation of China (AVIC), Chinese Aerospace Science and Technology Corporation, China Aerospace Science and Industry Corporation, China Elections Technology Group Corporation, China South Industries Group Corporation, China Shipbuilding Industry Corporation, China State Shipbuilding Corporation, Hikvision, Huawei, Inspur Group, China Railway Construction Corporation, China Mobile Communications Group, China Telecommunications Corp., China General Nuclear Corp.

2. <https://www.steptoeinternationalcomplianceblog.com/2020/06/us-department-of-defense-publishes-list-of-communist-chinese-military-companies-operating-directly-or-indirectly-in-united-states-pursuant-to-section-1237-of-the-national-defense-aut/>
3. <https://www.reuters.com/article/us-usa-china-comac-military-exclusive-idUSKBN29J2HK>

Jul 2020	The U.S. Department of Commerce added 11 Chinese entities due to their alleged involvement in human rights abuses in Xinjiang.	Changji Esquel Textile, Hefei Bitland Information Technology, Hetian Haolin Hair Accessories, Heitian Taida Apparel, K.T.K. Group, Nanjing Synergy Textiles, Nanchang O-Film Tech, Xinjiang Silk Road B.G.I., Beijing Liuhe B.G.I.
Dec 2020	The U.S. Department of Commerce added 77 entries to its Entity List for human rights abuses, the militarization of the South China Sea, and U.S. trade secret theft, of which 60 were Chinese companies.	Semiconductor Manufacturing International Corp (SMIC), DJI, Tongfang Nuctech Technology, China Communications Construction Company, Beijing Institute of Technology, Beijing University of Posts and Telecommunications, China National Scientific Instruments and Materials, China State Shipbuilding Corp. subordinates, Nanjing University of Aeronautics and Astronautics, Nanjing University of Science and Technology, Tianjin University
Jan 2021	The U.S. Department of Commerce added ten companies in two batches to its Entity List for acting contrary to the foreign policy interests of the U.S.	Aksu Huafu Textiles, CloudWalk Technology, FiberHome Technologies, Intellifusion, ISVision, Ministry of Public Security's Institute of Forensic Science of China, Nanjing FiberHome Starrysky Communication Development, NetPosa, SenseNets, China National Offshore Oil Corp.
Jan 2021	The Trump administration added 9 Chinese companies to a blacklist of alleged Chinese military companies, subjecting them to a U.S. investment ban that forces American investors to divest their holdings of the Blacklisted firms by Nov. 11, 2021 ⁴ .	Xiaomi Corp., Commercial Aircraft Corporation of China (COMAC), Advanced Micro-Fabrication Equipment Inc., Luokong Technology Corporation, Beijing Zhongguancun Development Investment Center, GOWIN Semiconductor Corp., Grand China Air Co., Ltd., Global Tone Communication Technology Co., Ltd, China National Aviation Holding
Apr 2021	The U.S. Department of Commerce added 7 Chinese supercomputing entities to its Entity List for their support to China's military modernization and other destabilizing efforts.	Tianjin Phytium Information Technology, Shanghai High-Performance Integrated Circuit Design Center, Sunway Microelectronics, the National Supercomputing Center Jinan, the National Supercomputing Center Shenzhen, the National Supercomputing Center Wuxi, the National Supercomputing Center Zhengzhou
Jun 2021	The U.S. Department of Commerce added 5 Chinese entities to its Entity List for participating in China's forced labor campaign against Muslims in Xinjiang.	These five companies were all located in Xinjiang, involving new energy, non-ferrous metals, and silicon industry, including Hoshine Silicon Industry (Shanshan) Co., Xinjiang Daqo New Energy, Xinjiang East Hope Nonferrous Metals, Xinjiang G.C.L. New Energy Materials Technology, Xinjiang Production and Construction Corp.
Jul 2021	The U.S. Department of Commerce added 34 entities to its Entity List to target enablers of China's human rights abuses and military modernization, and unauthorized Iranian and Russian procurement, 23 of which were Chinese companies and individuals.	China Academy of Electronics and Information Technology, iChinaE, DeepGlint, Sage Microelectronics Corp., Suzhou Keda Technology, Xinjiang Beidou Tongchuang Information Technology, Tongfang R.I.A. Co., Beijing Sinonet Science & Technology

Source: Federal Register, U.S. Department of Commerce

4. <https://www.reuters.com/article/us-usa-china-comac-military-exclusive-idU.S.KBN29J2HK>

Indeed, China's I.T. sector relies heavily on foreign products and services. It is the natural outcome of how China's technological development took place during the past forty years. China's tech development resulted from the country being integrated into the global industrial chain. It entered the global tech ecosystem from the lowest value chain and gradually migrated upstream. Countries including Japan and South Korea were able to achieve their technological rise through such integration.

For example, China's electronics industry developed tightly bundled

with imported foreign chips. In 2020, China imported U.S.\$380 billion chips to be used for both assembling products for exports and for domestic consumption. Chips alone accounted for about 18 percent of the country's total imports.⁵

Elsewhere, Microsoft has nearly 90 percent market share in China's desktop and server operating systems market.⁶ X86 server CPU has a 96.4 percent market share in China's servers market.⁷ Android dominates China's smartphone operating systems in China, with over 80 percent market share.⁸

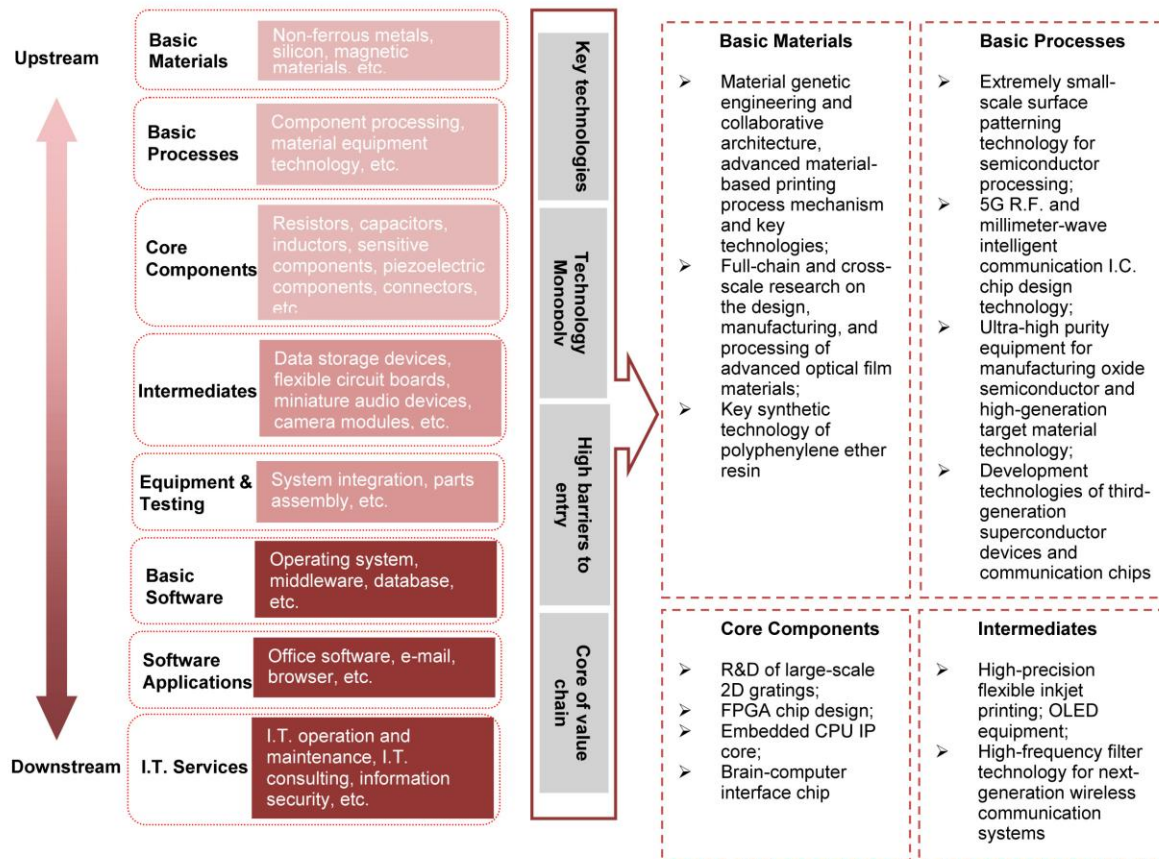
5.<https://www.gizmochina.com/2021/02/03/china-s-chip-imports-climb-to-nearly-380-billion-in-2020/>

6. https://www.voanews.com/a/east-asia-pacific_voa-news-china_chinas-computers-run-microsoft-windows-are-they-vulnerable-us/6190826.html

7.<https://www.idc.com/getdoc.jsp?containerId=prCHC46935220>

8.<https://www.statista.com/statistics/315113/market-share-held-by-smartphone-os-china/>

Exhibit 3- China's I.T. Industrial Supply Chain and Vulnerabilities



Source: University of Electronic Science and Technology of China, iResearch

The Chinese government has been attempting to reverse such reliance for some time. As early as 2014, Beijing unveiled policies to encourage government entities to install domestically-made computing devices with a domestic operating system equipped with domestic office software and domestic CPUs. Similar policies were announced in the ensuing years.

Such policy targeting to support domestic replacement picked up pace during the past few years. In the Fourteenth Five-Year Plan and the Long-Term Goals for 2035 unveiled in March 2021, Beijing made it clear that self-reliance would be China's long-term objective. The document stated that scientific and technological self-reliance should be regarded as key strategic support to China's future development.

Exhibit 4- A List of Self-Reliance and Xin Chuang-Related Policies On the National Level

Time	Policy	Details
Apr 2011	"Core electronic devices, high-end general-purpose chips, and basic software products" (He Gao Ji), one of 16 major scientific and technological projects determined by the National Medium and Long-Term Science and Technology Development Plan (2006-2020), began distributing funding to participating companies.	Several projects were funded to conduct research on domestic-made CPUs and operating systems (O.S.).
Jul 2014	The domestic replacement of office software used by Party/Government entities was launched.	The project aimed to promote the application of domestic-made CPU, operating system, database, and middleware to Party/Government entities in order to build an independent and controllable software ecosystem for the Party/Government sphere.
Oct 2014	China's Central Military Commission issued the "Opinions on Further Strengthening the Army's Information Security."	It stated that "information security must be guaranteed for military preparations," and China must "vigorously promote the construction and application of domestically-made independent information security."
Jan 2017	China's Ministry of Industry and Information Technology released "The Development Plan for Software and Information Technology Service Industry (2016-2020)."	It stated that China should "accelerate breakthroughs in basic technologies...and increase efforts to support the development and application of (domestic-made) basic software and products such as operating systems, databases, middleware, and office software.
Mar 2018	The Office of the Central Cyberspace Affairs Commission and the China Securities Regulatory Commission jointly issued the "Guiding Opinions on Promoting the Construction of A Powerful Network Country through Capital Markets."	It stated that China should "support and cultivate a group of I.T. companies with strong independent home-grown innovation capabilities and great development potential to be listed on China's Main board, Small and Medium-Sized Enterprise Board and ChiNext board.
Jan 2020	The State Council issued the "Administrative Measures for the Development of National Government Information Technology Projects."	It stated that "the safety and reliability of the products need to be studied during the government approval stage for any government information/digitalization project."
Mar 2020	The Ministry of Science and Technology issued the "Overall Plan for Promoting the Construction of the National Technology Innovation Center (Interim)."	It stated that China should "build a number of national technological innovation centers to break the key technological bottlenecks that restrict China's industrial security by 2025."
Apr 2020	The Ministry of Public Security, Ministry of International Security, and Ministry of Finance jointly issued the "Cybersecurity Review Measures."	Critical information infrastructure operators who purchase network products and services that affect or may affect national security shall be reviewed in accordance with the measures.

Aug 2020	The State Council issued the "Notice on Several Policies to Promote the High-Quality Development of the Integrated Circuit Industry and Software Industry in the New Era."	It stated that China should "encourage the development of the (Chinese) integrated circuit industry and software industry in terms of finance and taxation, investment and financing, research and development, import and export, talents, intellectual property rights, market applications, and national cooperation, and vigorously cultivate enterprises in the (Chinese) integrated circuit and software fields."
Sep 2020	The National Development and Reform Commission, the Ministry of Science and Technology, the Ministry of Industry and Information Technology, and the Ministry of Finance jointly issued the "Guiding Opinions on Expanding Investment in Strategic Emerging Industries, Cultivating New Growth Engines and Growth Levels."	It stated that China should "accelerate research on core technologies such as basic materials, key chips, high-end components, new display devices, and key software, promote the construction of major projects."

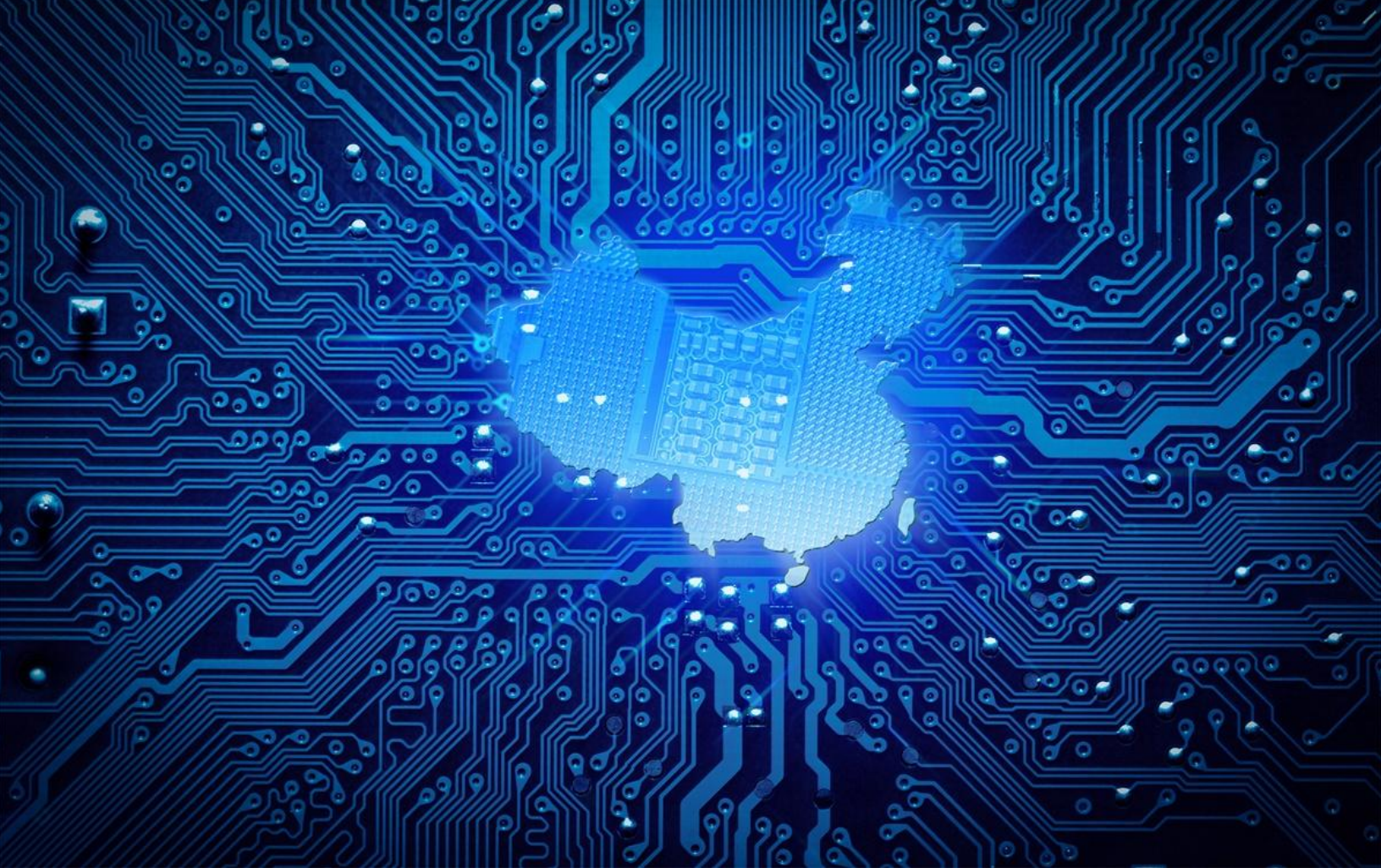
Source: public announcements.

Exhibit 5- Select Xin Chuang-Related Policies on the Regional Government Level

Time	Policy	Details
Mar 2019	Framework Agreement for Jointly Promoting the Construction of Jiangsu Province's Information Technology Application Innovation and Industry Ecosystem.	To establish an adaptation center, R&D center, achievement exhibition center, cloud service data center, industry incubation platform, and public service platform for Xin Chuang products in Jiangsu province.
May 2020	Guiding Opinions on Kunpeng Computing Industry Training to Promote the Innovation and Development of Digital Xiamen.	To build a national industrial cluster based on Kunpeng's ecosystem, gather a group of well-known upstream and downstream enterprises on Kunpeng industrial chain, and form a 100-billion-yuan Kunpeng industrial cluster in Xiamen city. (Kunpeng computing platform encompasses Huawei's Kunpeng processor, server, terminal, storage system, database, and related software.)
Oct 2020	Guangzhou Huangpu District and Guangzhou Development Zone on Promoting the Development of Xin Chuang Industry.	This was China's first regional policy to support Xin Chuang projects and included ten Xin Chuang-related incentives and subsidies to encourage the development of Xin Chuang-related enterprises in Guangzhou city.
Oct 2020	Zhejiang province's Jinhua city-issued "Notice on Issuing Jindong District's Policy Opinions on Promoting the Development of Key Manufacturing Industries (Trial)."	It called for building a national Xin Chuang industry demonstration center and creating an industrial chain from key electronic information materials, chip design, packaging and testing, system integration to intelligent applications in Jinhua city.

Feb 2021	Beijing municipal government issued "Work Plan for the Construction of 'Two Zones' in the Field of Digital Economy."	It stated that Beijing should "cultivate new digital economy models, establish a new ecosystem of independent development of the digital economy represented by the Xin Chuang industry, develop a number of industrial Internet platforms and sub-industry platforms, and accelerate the development of next-generation I.T. industries."
Feb 2021	Shenzhen city-issued "Science and Technology Innovation Action Plan for the Pilot Demonstration Zone of Socialism with Chinese Characteristics."	It stated that Shenzhen should "strengthen research on key technologies, optimize supporting methods...and focus on making breakthroughs in core technologies in the integrated circuit industry."
Mar 2021	Wuhan city-issued "Notice of Accelerating the Implementation Plan of Wuhan Cloud Construction."	It stated that Wuhan should "build a Wuhan Xin Chuang cloud resources pool, use domestic-made chips, servers, and password protection systems to build a Xin Chuang ecosystem, provide information infrastructure services based on Xin Chuang, and achieve independent and self-reliant innovation
May 2021	Tianjin municipal government released "'14th Five-Year Plan' for Intellectual Property."	It called for Tianjin city to "improve the quality of I.P. rights in the Xin Chuang industry and cultivate a number of high-value patents."

Source: public announcements.



The Scale of the Xin Chuang Industry

In 2023, the market size of China's *Xin Chuang* industry is expected to exceed U.S.\$52 billion, while the overall market capacity will exceed RMB1 trillion Yuan (U.S.\$155 billion), according to a research report issued by the Chinese Institute of Electronics and Urtrust Think Tank in January 2021.⁹

These estimates were based on the projection that 50 percent of the Chinese computing industry, which is expected to be worth around U.S.\$104.3 billion in 2023, be in the form of *Xin Chuang* or domestic systems.

9. <http://eversec.com.cn/wp-content/uploads/2020/08/%E4%B8%AD%E5%9B%BD%E4%BF%A1%E5%88%9B%E4%BA%A7%E4%B8%9A%E5%8F%91%E5%B1%95%E7%99%BD%E7%9A%AE%E4%B9%A62021.pdf> (the report is available in Chinese)

Exhibit 6- The Chinese and Global Computing Industry Market Forecast in 2023(unit: \$billion)

Category	Product	Global		China		
		Market Size	5-year CAGR	Market Size	5-year CAGR	Global Share
Hardware	Server	112.1	3.7%	34	12.4%	30%
	Enterprise storage	31.1	1.0%	6	6.9%	19%
Software	Infrastructure software	152.5	5.3%	2.9	198%	2%
	Database	56.9	7.5%	4	26.9%	7%
	Middleware	43.4	10.3%	1.4	15.7%	3%
	Big data platform	41	15.6%	2.7	44.7%	6%
	Enterprise application	402	8.2%	15.6	1170%	4%
Cloud Computing	Public cloud	141	31.4%	28.9	51%	20%
	SaaS in cloud	29.6	44.8%	/	/	/

Source: I.D.C., Urtrust Think Tank

Beijing's long-term plan for the *Xin Chuang* industry will be carried out in three phases. First, China will nurture a self-reliant market in the relatively closed government and Communist Party-related sphere valued at dozens of billions of dollars.

Then, domestic replacements will expand to key state-owned sectors such as telecommunications, rail, electricity, health care, aerospace, and energy, whose size could be four to five times bigger. The last step is to push *Xin*

Chuang to the consumer market, which includes consumer phones and computers, that is worth hundreds of billions of dollars.

The *Xin Chuang* industry consists of four parts: basic hardware, basic software, application software, and information security. Chips, computing devices, operating systems, databases, and middleware are some of the most important components of the sector.

Exhibit 7- The Chinese Xin Chuang Industry Overall Landscape

Industrial Applications 2+8	Government	Finance	Telecom	Software	Office	Social Networking	Information security			
	Oil and gas	Electricity	Transportation		E-mail	Business software	Security Management	Security Technology	Security Standards	
	Aerospace	Healthcare	Education		Browser	...				
Platform software	Database		Middleware		Cloud computing platform					
Operating system	Server O.S.		Desktop O.S.		Embedded OS					
Hardware	Design	ODM	Complete machine	Server	Desktop	Peripheral				Printer
		OEM		Special computer	Laptop					Scanner
Chips	Loongson	Phytium		Kunpeng	Sunway	Hygon				Zhaoxin

Specifically, China's data center market was valued at U.S.\$13 billion in 2020 and is expected to reach \$36 billion by 2026 while registering a compound annual growth rate (CAGR) of 19.2% during the period of 2021 to 2026.¹⁰

China's cyber security market is forecast to reach a projected market size of U.S.\$70 billion by the year 2027, trailing a CAGR of 13.6% over the period of 2020 to 2027.¹¹

In many other information technology segments, including servers, enterprise applications, public cloud, and big data platforms, the Chinese market is expected to experience rapid growth going forward. Beijing's objective is to have Chinese companies grab a significant portion of this future growth and obtain significant domestic market share.

10.<https://www.mordorintelligence.com/industry-reports/china-data-center-market>

11.<https://www.businesswire.com/news/home/20210809005513/en/Global-Cyber-Security-Market-Trajectory-Analytics-Report-2021-Market-to-Reach-296.5-Billion-by-2027---Endpoint-Security-is-Forecast-to-Account-for-100.2-Billion---ResearchAndMarkets.com>



Key Players in China's Xin Chuang Market

After years of development, leaders in each segment of the *Xin Chuang* industry have emerged. From operating systems, CPU platforms, databases, cyber security to applications, a wide range of Chinese companies offer domestic replacement options for foreign products in each market segment.

Exhibit 8- Key Companies In China's Xin Chuang Industry



Exhibit 9- Chinese Domestic Replacement Options for Foreign Chips and Operating Systems

	OS	CPU	Database	Middleware	Information security	Application software	Main clients
WinTel Alliance	Microsoft Windows	Intel	Oracle DB2 MariaDB MySQL	Weblogic Websphere Tuxedo Jboss Tomcat	KnowBe4 Raytheon FireEye R.S.A. Symantec	Oracle Autodesk Adobe ...	Amazon G.E. Walmart ...
Chinese Domestic Systems	Kirin UnionTech NFS-China Hongqi iSoft	Loongson Phytium Sunway Kunpeng Hygon Zhaoxin	Wuhan Dameng, King Base, Shentong Data, GBASE	TongTech CVICSE Apusic	Venustech, Qihoo 360, STAR-NET, QI-ANXIN, Zhongfu Information	Kingsoft Smartdot Weaver ...	C.P.C. Central Office, Ministry of Commerce, National Development and Reform Commission, PetroChina, China Unicom, Sun Yat-sen University ...

In the processor chips market, the main players in China include Loongson, Zhaoxin, Phytium, Hygon, Sunway, and Huawei.

Among them, Zhaoxin and Hygon chips are based on the X86 kernel. Phytium's FeiTeng 11 and Huawei chips are based on A.R.M.'s authorized instruction set, upon which they independently designed their own CPU core. Loongson chips use a self-developed instruction set based on the MIPS architecture, while Sunway uses its own self-developed instruction set of SW64, which has the highest degree of autonomy among all the chips.

The chips using X86 and A.R.M. instruction sets, such as Hygon, FeiTeng, and Huawei, can take advantage of the mature technology and ecosystem provided by these two globally leading platforms. But they face uncertainty going forward as U.S. sanctions have cut off their access to foreign I.P. All three companies have been placed on the U.S.'s Entity List, and their American partners have announced that they would suspend working with them.

Loongson and Sunway have the greatest autonomy in terms of having self-developed instruction sets, but their ecosystems are in a very early stage and will require a long time to be built up.

Exhibit 10- Major CPU Companies Categorized By Instruction Set

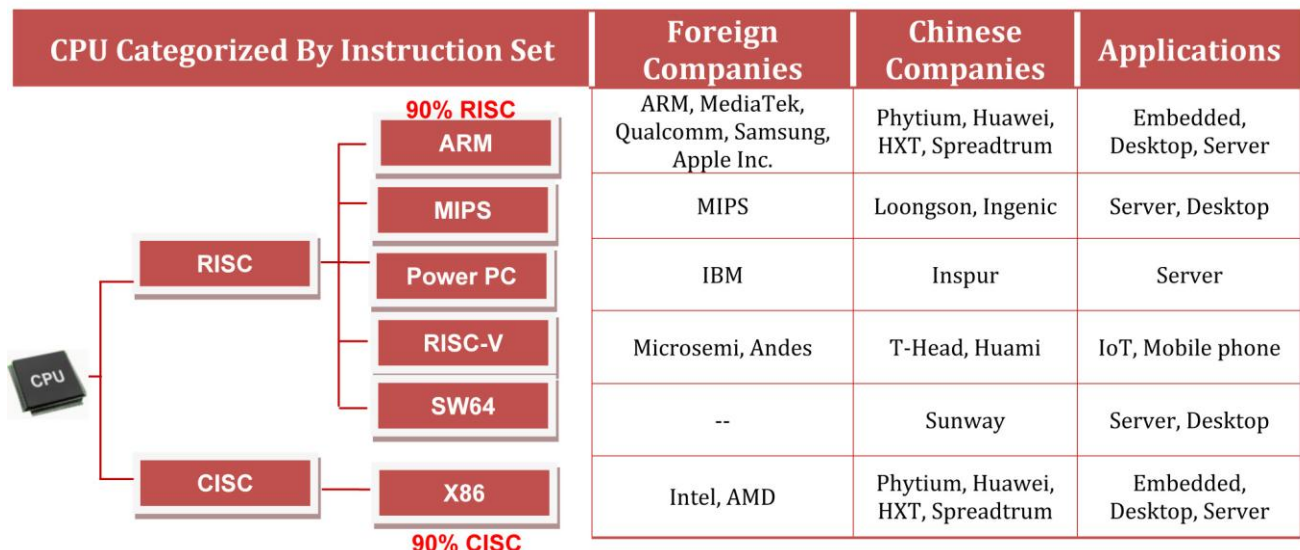


Exhibit 11- Technological Development Paths of Chinese Domestic CPUs

Instruction Set Authorization	Technological Paths	Companies	Degree of Autonomy
I.P. kernel authorization	X86 kernel authorization SoC integrated design based on instruction systems	Zhaoxin Hygon	Low degree of autonomy, faces challenges to expand the instruction set in the future, X86 ecosystem is relatively easy to migrate
Instruction set authorization	A.R.M. instruction set authorization Independent design of CPU core based on instruction set architecture authorization	Huawei Phytium	Higher degree of autonomy, relatively solid security foundation with independent self-development, but faces uncertainties as A.R.M. suspends authorizing new generation of instruction sets
Authorization + Self-developed instruction set	Self-developed instruction set MIPS+ Self-development Self-developed SW64 instruction set	Loongson Sunway	Highest degree of autonomy, Sunway has almost achieved complete autonomy and controllability, but the ecosystem is very immature

Chinese companies provide domestic replacement options in the semiconductor industrial chain, including chip design, chip manufacturing, manufacturing equipment, E.D.A. software, materials, chip testing, and packaging.

But the technological gap is gigantic in many of these links, including chip manufacturing, E.D.A., materials, and manufacturing equipment. China faces significant challenges in building up comparable domestic capacity in these highly advanced industries.

Exhibit 12- Chinese vs. Foreign Companies across the Semiconductor Industrial Chain

China	Naura, A.C.M. Research, Cmsemicon, Wanye Enterprises, Best Semiconductor, AccoTEST, HWATSING, P.N.C., Jingce Electronic	National Silicon Industry Group, Konfoong Materials International, ThinkonSemi, Dinglong, Jinhong Gas, Yoke Technology	Empyrean, Cambrian, VeriSilicon, Tangoic, X-EPIC, Innosilicon	Huawei, Phytium, Sunway, Loongson, Hygon, Lighthouse	SMIC	Fujitsu Microelectron ics, JCET, Huatian Technology
	Equipment	Material	EDA/IP	Design	Manufacturing	Packaging & Testing
Foreign	Applied Materials (U.S.A), ASML (Netherlands), Tokyo Electron (Japan), Lam (U.S.A), KLA-Tencor (U.S.A), ADCMT(Japan), Teradyne(U.S.A)	Shin-Etsu Chemical (Japan), SUMCO (Japan), Cabot (U.S.A), DOW Chemica (U.S.A), Sumitomo Chemical (Japan)	Synopsys (U.S.A), Cadence (U.S.A), Mentor Graphics (Germany), ARM(U.S.A)	Intel(U.S.A), AMD(U.S.A), APPLE (U.S.A), Samsung (Korea), IBM(U.S.A), Qualcomm (U.S.A), MediaTek (Taiwan China)	TSMC (Taiwan China), Intel (U.S.A), Samsung (Korea), Global Foundries (U.S.A)	ASE Group (Taiwan China), Amkor (U.S.A), SPIL(Taiwan China), Intel (U.S.A), Samsung (Korea)

In operating systems, there are many Chinese companies providing alternative products, but the penetration ratio of the domestic

products remains very low, and the related ecosystem needs to be expanded to improve usability.

Exhibit 13- A List of Major Operating Systems In China

Major Operating Systems	Company	Application	Adaptive Chips
KylinOS, NeoKylin	KylinSoft	Desktop, server	Phytium, Kunpeng, Loongson, Sunway, Hygon, Zhaoxin
U.O.S.	UnionTech	Desktop, server	Loongson, Phytium, Sunway, Kunpeng, Zhaoxin, Hygon, etc.
iSOFT	iSoft Infrastructure Software	Desktop, server	Loongson, Sunway, etc.
N.F.S.	NFS-China	Desktop, server	Zhaoxin, etc.
EulerOS, Harmony OS	Huawei	Server, IoT	Kunpeng, X86
NewStart	ZTE	Desktop, server	Loongson, Zhaoxin, ARM

Among them, Kylin O.S. is backed by the support of the National University of Defense Technology of China and focuses on developing dual-use operating systems for both military and civilian use.

Due to its close relationship with the Chinese government and military, its Neokylin OS has been widely adopted by China's national defense, aerospace, electric power, energy, and government sectors. While its open-source server O.S. Kylin targets China's military server market.¹²

Meanwhile, Uniontech OS focuses on the development of domestic operating systems based on Linux. Its Deepin OS has been downloaded more than 100 million times and is available in 30 languages.

In 2020, UnionTech announced a strategic partnership with Huawei. Uniontech OS has completed the adaptation of over 1,000 Huawei software and hardware products, including processors, desktops, servers, data centers, and desktop cloud.¹³

In July 2021, Uniontech released UOS V20 Pro, which claims to support both Android and Windows applications. Uniontech also released U.O.S. Education, which is hoping to take more market share in the education operating systems market in China.¹⁴

Uniontech OS has been used by dozens of governments and nearly 50 industry clients in China.¹⁵ It recorded RMB145 million in revenues and suffered a loss of RMB111 million during the first three quarters of 2020 due to significant expansion of its workforce.¹⁶

Elsewhere, Chinese companies are able to capture a larger domestic market share. For example, the Chinese database market is expected to reach RMB24.7 billion Yuan (U.S.\$3.8 billion) in 2020, and foreign vendors take around 52.6 percent of the market share. But domestic vendors are growing rapidly, increasing their market share by 7.1 percentage points in 2020.¹⁷

12.<https://jishuin.proginn.com/p/763bfbd3501f>

13. <https://www.uniontech.com/3592.html>

14.<https://www.infoq.cn/article/gxjbjtwgq3zkalophlh1>

15. https://www.sohu.com/a/440040733_115565

16.https://stock.finance.sina.com.cn/stock/go.php/vReport_Show/kind/search/rptid/656086614333/index.phtml

17.https://www.iresearchchina.com/content/details8_66960.html

Exhibit 14- Major Chinese Domestic Database Service Providers & Projects

Company	Internet Projects	Banking Projects	Telecom Projects	Government Projects	Others
Alibaba Oceanbase	PICC Health Insurance cloud core business system database	"Xinyun+" internet financial platform for Bank of Nanjing	China Mobile (Zhejiang province) I.T. system independent and controllable capacity construction	Hangzhou Government's E.T. City Brain 2.0	SAIC Simulation Computing Cloud, Mondelez Group's digital upgrade, Alibaba Cloud's ET Brain
Tencent	Kuaishou's cloud video service, Bilibili's live and on-demand streaming services	CCB-Tencent Fintech Joint Innovation Lab	China Unicom's Wo Cloud powered by Tencent cloud	Shenzhen Public Security Bureau's People's livelihood policing solution	Didi Chuxing's rapid order distribution system
Huawei GaussDB	National Administration of Surveying, Mapping and Geoinformation's general geospatial information website	ICBC's distributed architecture big data service platform	China Mobile (Zhejiang)- Huawei GaussDB Joint Innovation Project	/	J.A.C. Motor's connected vehicle operation
ZTE GoldenDB	Jiangsu Rural Credit Union's internet finance platform	China CITIC Bank's credit card system and core system for its head office, China UnionPay's credit card system, SPDB's credit card system, D.R.C. Bank's credit card system	/	Guangdong Provincial Rural Credit's file management system	/
GreatDB	/	RuiPay's order trading system, Everbright Bank's cloud payment system	China Mobile's business analysis system	China Meteorological Administration's emergency warning system	State Grid's full-service data center
PinCAP	Zhihu's content push system	China Everbright Bank's distributed database, Bank	/	Jilin's cloud government affairs big data platform	Wanda Internet Technology Group's real-time risk control platform

		of China's Zabbix monitoring solution			
Vestore	China Guodian Group's Online electric power material trading service center	/	/	North China Electric Power University(NCEPU)'s Big Data Energy Industrial Control System Application Project, State Key Laboratory Of Alternate Electrical Power System With Renewable Energy Sources (NCEPU)'s power generation process	C.H.N. Energy's Jiangsu subsidiary and its affiliated Taizhou company's smart enterprise project, China Datang Corporation Renewable Power's production monitoring system

China's cyber security market is forecast to reach a projected market size of U.S.\$70 billion by the year 2027, trailing a CAGR of 13.6% over the analysis period 2020 to 2027.¹⁸

New H3C Technologies Co., Sangfor Technologies, Qi An Xin Technology, and Qihoo 360 Technology are domestic leaders taking most of the positions as domestic market leaders.

Exhibit 15- Major Players in China's Information Security Market (2019)

Product Type	Product Classification	No.1 in market share	No.2 in market share	No.3 in market share
Hardware	Firewall	H3C	Huawei	TOPSEC
	Unified Threat Management(UTM)	Leadsec	Sangfor	Qi-Anxin
	Intrusion Detection Systems/Intrusion Prevention System(IDS/IPS)	Venustech	NSFOCUS.	H3C
	VPN	Sangfor	TOPSEC	Venustech
	Secure Content Management	Sangfor	Qi-Anxin	H3C
Software	Terminal Security Software	Qi-Anxin	AsiaInfo Security	Qihoo 360
	Identity and Digital Trust Software	J.I.T.	AsiaInfo Security	BJCA
	Government and Enterprise Browser	Firefox	Qihoo 360	Haitai Fangyuan

18.<https://www.businesswire.com/news/home/20210809005513/en/Global-Cyber-Security-Market-Trajectory-Analytics-Report-2021-Market-to-Reach-296.5-Billion-by-2027---Endpoint-Security-is-Forecast-to-Account-for-100.2-Billion---ResearchAndMarkets.com>



Challenges for China's Xin Chuang Market

Despite strong policy support and China's market scale advantage, there are several challenges in China's efforts to beef up its *Xin Chuang* market.

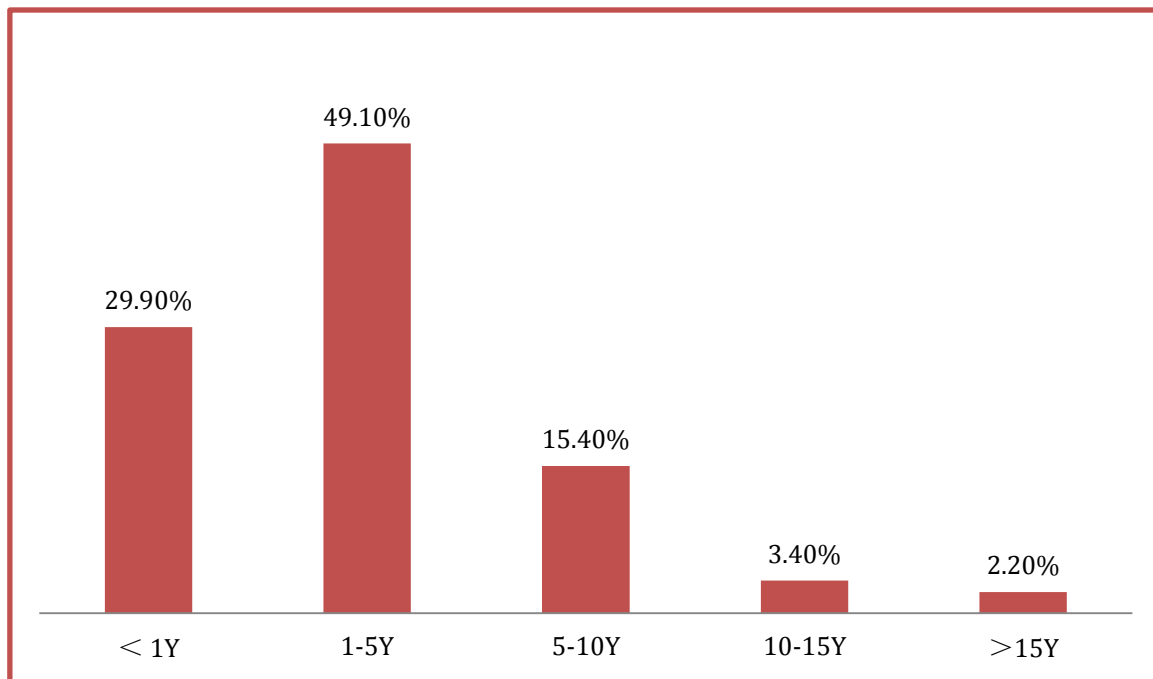
In semiconductors, for example, government support led to a boom in the industry. In 2020 alone, over 20,000 new semiconductor companies were established in China. There were 73,000 semiconductor companies operating in the country as of the end of 2020.¹⁹

But this irrational exuberance could lead to vast waste of resources, as previously happened in other sectors such as China's solar panel market. Around 30 percent of China's semiconductor companies were established within a year, and approximately 18.4 percent of them did not survive beyond one year.²⁰

19. <https://finance.sina.com.cn/tech/2021-01-19/doc-ikftpnx9328742.shtml>

20. <http://report.iresearch.cn/wx/report.aspx?id=3814>

Exhibit 16- Chinese Semiconductor Companies Divided By Year of Operations



More importantly, there is no comprehensive plan designed specifically to break the bottleneck areas. In E.D.A. software, for example, foreign players dominate the Chinese market. The three biggest global players Synopsys, Cadence, and Mentor Graphics has over 95 percent market share in China.²¹ While out of the dozens of domestic E.D.A. companies, only one company Emyrean Technology, has more than 100 employees.²²

As the leader of China's domestic E.D.A. industry, Emyrean Technology recorded 410 million yuan (U.S.\$64 million) in revenue and 100 million

yuan (U.S.\$15.6 million) in net profit in 2020, while spending 180 million yuan (U.S.\$28 million) in R&D and counted 477 total employees.²³

In comparison, Synopsys recorded U.S.\$3.69 billion in revenue and U.S.\$664 million in net income in 2020 while spending U.S.\$1.28 billion in R&D and counting over 15,000 employees.²⁴

Such massive gaps will take decades to close, as China's E.D.A. industry needs to consolidate, cultivate a client base, increase R&D spending, educate and train talent, scale-up, as well as improve their technology.

21. https://pdf.dfcfw.com/pdf/H3_AP202005301381115047_1.pdf?1590915265000.pdf
22. https://www.sohu.com/a/343588328_166680

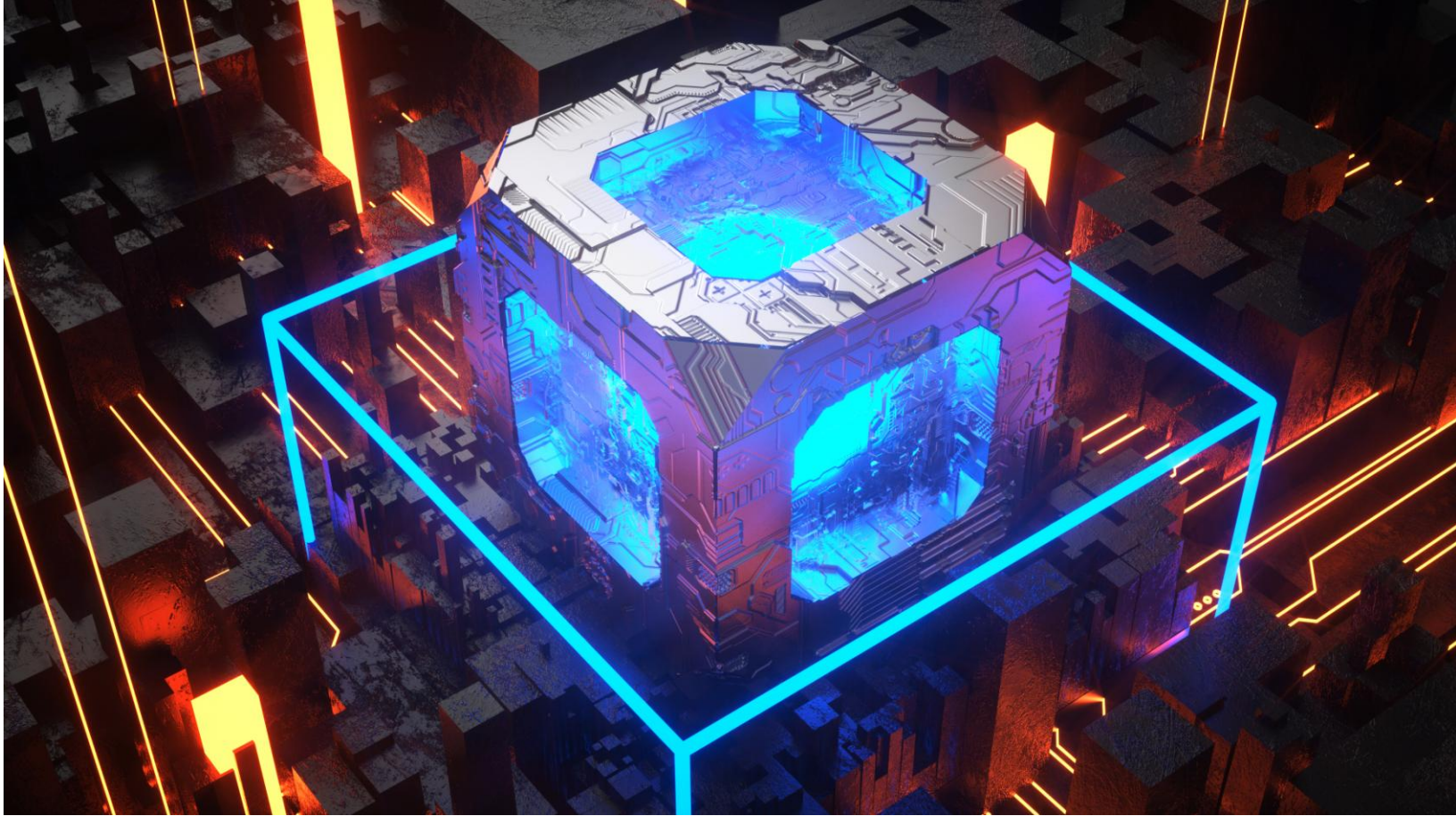
23. <https://wallstreetcn.com/articles/3633593>
24. <https://news.synopsys.com/2020-12-02-Synopsys-Posts-Financial-Results-for-Fourth-Quarter-and-Fiscal-Year-2020>

Similarly, Chinese companies lag global market leaders by two generations or more in manufacturing nodes in semiconductor manufacturing. Such a gap will take decades to close.

Xin Chuang products also have a long way to improve quality and build up relevant ecosystems. In operating systems, by one estimate, around 30 to 40 percent of Chinese government and Party-related entities have shifted their O.S. to domestic products.²⁵ But because of poor functionality and an immature ecosystem (lack of applications and services), the user experience has been unsatisfactory. These factors could slow down the domestic replacement campaign.

Regional fragmentation and lack of coordination also present another challenge. Currently, there are many small and regional competitors in the *Xin Chuang* industry, creating adaptability and interoperability issues among chip I.P., O.S., and applications. Lacking a unified and dominant O.S. ecosystem, it hinders the ability of app developers and other industry participants to build up a coherent tech ecosystem.

25. report.iresearch.cn/wx/report.aspx?id=3814



Global Implication of China's Xin Chuang Effort

China's database sector can be viewed as an example of success for its Xin Chuang effort. It has achieved high technological sophistication and has a vibrant domestic industry. Domestic providers were able to take a 47.4 percent of the Chinese database market, a very high ratio compared to other Xin Chuang market segments.

China is likely to make reasonable progress in domestic replacement in the next decade in markets such as Internet-of-Things (IoT) O.S., cyber security, cloud computing, computing devices, and servers. These markets do not have as high technological barriers or long R&D cycles as chip manufacturing. As a greater share of these markets are captured by Chinese

companies, foreign companies will gradually lose market share and influence over the Chinese market.

But in areas like chip I.P., E.D.A. software, chip manufacturing, operating systems, and application software, the technological gap between China and the global leaders remains vast. It will take China a long time to achieve progress in these areas. Any domestic replacement success will come gradually, first in more mature tech areas and then slowly moving toward advanced ones.

In addition, China's success in achieving total self-reliance cannot be taken for granted neither. With greater uncertainty in China's economic, political, geopolitical, and regulatory environment, how China's *Xin Chuang* industry will evolve for the long term is highly uncertain, pending shifts of its external environment and China's domestic political wind.

For the foreseeable future, China will remain dependent, and therefore integrated, with the global tech ecosystem. With China having to rely on foreign tech on advanced tech, the country's tech decoupling away from the global system will be selective and confined to certain sectors.

The Chinese market will remain open to some foreign companies even in the sectors where domestic suppliers are destined to take increasingly larger market share, such as databases, cloud computing, and cyber security.

There is no nation-wide definition of what constitute a "domestic-made" products, but many local Chinese governments have defined them as products having around 50 percent of its total costs coming from domestic sources. It means foreign companies will need to navigate a complicated operating and increasingly stringent regulatory environment to succeed in China.

